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ABSTRACT

America is shifting from an industrial age to a technological age and the computer has an expanding role in our everyday lives. The key to the expansion of education over the coming decades will be the computer, which, in every kind of setting from schools to the home to the library to the community, will enhance individualized instruction. This will present challenges not only in our own country, but in the international arena as well. When faced with such challenges this nation will turn to higher education for practical solutions. In accordance with the Reagan Administration's desire to promote less federal control and more state, local, and institutional autonomy in education, there will be no massive federal aid program to provide software and/or hardware for universities, although currently funded programs--student loans and grants for innovative projects from the Fund for the Improvement of Postsecondary Education (FIPSE)--will help higher education to participate in the technology revolution. The specific contributions of higher education might be: (1) research that assists business and industry to advance the technological frontier; (2) education and training of scientific and technical manpower needed by business and industry; (3) preparation of all citizens to live in a technological society in which decisions are increasingly based on scientific and technological considerations; and (4) research on how best to use technology to advance education at all levels. The advantages of electronic learning can give greater access to education and more extensive educational opportunities, and enhance the relationship between teachers and students. A great educational system can further expand by developing a more knowledgeable population and informed worker and consumer. An expanded and better educated population can assist American productivity at home and American leadership in the world. (DJR)

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"Higher Education and Technology--The Challenge We Face in the 1980s"

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Good Evening.

It is a great pleasure to be here at Loyola University and to have the opportunity to address such a distinguished group of educators on a topic of such vital importance -- higher education and technology. This topic requires us also to focus on what exactly is the role of technology -- especially instructional technology--in our society presently. The questions are obvious: Is it a fad? Is it another "buzzword" of the education establishment designed to produce flurry of activity but with few lasting results? Or is it something which will bring a profound and lasting change not only in education but in our society?

Allow me to focus on three important commentaries on our present society.

First, we are moving from the "Industrial Age" to the "Information Age"--a very significant development in how our society will be functioning. In Megatrends: Ten New Directions Transforming Our Lives, John Naisbitt talks of a restructuring of American society now evolving with an economy based on the creation and distribution of information. This movement in the dual direction of high tech/high touch, he reminds us, matches each new technology with a compensatory human response. With the coming of that information society, we have an economy for the first time based on a key resource which is not only renewable but self-generating--an integrated information and communication system than transmits data and permits instantaneous interaction between persons and

computers. "Information" is that key resource; self-generation is the issue. Naisbitt perceptively comments:

> Running out of it is not a problem, but drowning in it is...We are drowning in information but starved for knowledge.

Second, the computer is a given; it exists; it has an expanding role in our everyday life and more and more aspects of our society are being influenced by the use of the computer.

Dr. Herbert A. Simon, University Professor at Carnegie-Mellon University, has placed the development of the computer in proper perspective, especially as we relate its use in the field of education.

> Nobody really needs convincing these days that the computer is an innovation of more than ordinary magnitude, a one-in-several-centuries innovation and not a one-in-a-century innovation or one of these instant revolutions that are announced every day in the papers or on television. It really is an event of major magnitude.

By careful observation and the use of imagination, it is not necessary to be either a seer or a sage to realize that the key to the expansion of education over the coming decades will be the computer which in every kind of setting from the school to the home to the library to the community will enhance individualized instruction. A Nation At Risk, the report of the National Commission on Excellence in Education, challenged our nation to set the goal of building a "Learning Society." Education has a better chance of becoming a lifelong pursuit from computer lessons in kindergarten to graduate degrees for senior citizens by use of the computer.

The computer will stimulate profound changes in education over the next decades. It has already profoundly affected the acquisition of knowledge and the conduct of research in higher education. Its effects on the organization and retrieval of information especially on library functions are becoming increasingly evident. It will soon affect changes in the number of off-campus students and on education out-of-school. And together with new knowledge from research in cognitive science, it must ultimately affect teaching and learning in the classroom.

Computer technology and telecommunications have so blended in the last decade that there is barely a distinction. Computers are relied upon by communications technology at almost every step in the processing of messages and the routing of messages as well as the processing and routing of conversations. Any serious computer can be used as a sophisticated communications device. In an article entitled "The Unpredictable Computer", the authoritative Far Eastern Economic Review (November 10, 1983) noted that the microcomputer driven by a single, relatively inexpensive chip called a microprocessor, has brought about a revolution. The article noted:

> The real impact of this revolution is coming with the exploitation of the microcomputer's communications potential along with its conventional calculation and word-processing functions. Equipped with a modem, the microcomputer can be linked over telephone lines to other computers around the world to send and receive messages, retrieve information from external data bases and electronic bulletin boards or newsletters, or to pass on data for external processing.

Third, computers are becoming a part of the material or equipment students are taking to colleges and universities. The unusual roommate one discovers on campus today for the college freshman is the personal desk top computer.

Institutions of higher education are considering plans to use computers in every field of learning. A handful of colleges such as Stevens Institute of Technology (Hoboken, New Jersey), Clarkson College (Potsdam, New York) and Carnegie-Mellon University (Pittsburgh, Pennsylvania) require students to have computers. Even college book stores, in some instances, are becoming computer stores. Computer programs are being especially designed for college classes.

The computer offers to bring a new dimension to the focus of learning. Television offers a passive form of learning for the home and school, a one way reception by the student; the computer offers an interactive means of education in which the instructor and student can interact and exchange information hundreds or even thousands of miles away, eliminating time and geographic barriers.

Electronic learning has a great potential now just barely being realized for American education.

We can reach out to more and more people with a new system--computer to computer communication.

Education--particularly postsecondary--can go beyond barriers--people isolated in villages, prisons, nursing homes and confined for any reason at home or in an institution--can have access to a wide variety of learning.

Just recently, a private organization announced the development of the first "electronic university." A number of colleges and universities have agreed to allow credit in their institutions for students taking courses via this electronic university.

One can imagine the great potential of this development for post-secondary education. Individuals can take courses or whole programs in their homes for training for the sake of learning new things or to prepare for new careers. We are living in a rapidly changing age when individuals can no longer be content with one career during a lifetime but may need to prepare for two or three or more career changes in a lifetime. Computers offer the individual a regular opportunity to upgrade skills or to acquire new skills. Knowledge can be more widely diffused in the career arena and great steps toward equity as under employment and underutilization of human resources can be eliminated, or certainly minimized. Corporations will have greater opportunity to train, retrain, and upgrade training of their workforce in a world growing more competitive for the United States.

Electronic learning via computers allows even more than other telecommunication developments the use of other than school rooms for education--libraries, museums, community centers, and one's own living room.

The interactive nature of communication plus pictures and graphics will allow students to get the benefit of outstanding teachers in specialized fields. Students' contact with teachers will be enhanced--thousands of miles away yet still with direct contact.

Computer learning can be best adopted to the best method for the individual student. Students can work at their own speed on desk top computers on different subjects; a student can drill as much as he or she needs without taking up unnecessarily the time of the teacher and fellow classmates. Based on individual evaluation, students who learn better through hearing would receive much of their instruction orally while those who learn better through visual information would spend more time reading and writing on visual screens.

As with any new development especially one representing such a vast change, the role of the federal government is an evolving one and is one under current debate. Allow me to outline observations on the role currently from the perspectives of this Administration.

First and foremost, the federal government recognizes the great benefits to higher education of technology and seeks to impose no barriers as institutions of higher education makes their decisions on ways and means to proceed. The Reagan Administration seeks to promote a concept of an opportunity society so these advances can take place with minimal interference.

Second, in accord with this Administration's desire to promote less federal control and more State, local and institutional autonomy in education, there will not be a massive federal aid program providing for software and/or hardware for universities. Such a program if undertaken would be very expensive, could easily ignore the different needs of vastly differing institutions and could pose threats to a university's decision-making powers in a vital area such as curriculum.

Third, there will be a continuation of federal programs which will assist in an indirect and direct means for higher education to participate in the technology revolution. The student loan program will continue to provide grants and loans to students so they follow studies preparing themselves for the new work opportunities in technology. There is also the FIPSE program (Fund for the Improvement of Postsecondary Education) which operates from our Office of Postsecondary Education. FIPSE makes specific grants for innovative projects in higher education and in recent years under the Reagan Administration these grants have favored projects in technology. Grants for Fiscal Year 1983 included the following projects: teaching macroeconomics using VISICALC software as a classroom lecture complementary activity (Colorado State University); developing a national inventory of microcomputer uses in education and an inventory of the uses of other electronic technologies (Harvard Graduate School of Education); extending verbal, mathematical and computer literacy training to rural adults (University of Idaho); developing a flexible computerized medical textbook in pathology which allows this "living text" to be continually updated and serve not only as a continuing education system but as an information bank (University of Illinois College of Medicine); developing a computer program to stimulate phenomena in optics, a program which can be used for junior high through graduate school (University of Maryland); establishing an institute to train computer science faculty from small liberal arts college in improved teaching methods and in techniques to better meet student needs (Union College, Lincoln, Nebraska); and designing as well as implementing a computer assisted academic advisement

program using the PLATO system (University of Delaware). These grants provide the important funds to develop programs which can be disseminated to other postsecondary institutions.

The "technology revolution" so often referred to in the media is here and now; it is not in the future. This technology revolution is bringing us to new frontiers of knowledge as the torch is passed from leaders of the industrial age to leaders of the information age. It challenges us not only in our own country but in the international arena of global competition. If the United States is not to disappear from the roll call of leading economic powers, we must recognize and adjust to the challenge of economic competition through the explosion of technology.

When faced with a challenge, this nation has a long history of turning to higher education for practical solutions. The Morrill Act (1862), which had such a profound effect on the productivity of agriculture in this country, is an early example. The close collaboration between university scientists and engineers that contributed immeasurably to our country's victory in World War II is a more recent one. A grateful nation subsequently financed the "golden age of American university development" for the 25 years between 1950 and 1975.

I selected these two of many possible examples because they are essentially technological in character. The nation now appears to be facing a new international challenge to its economic competitiveness that many think has also a strong technological character. It is

natural that we should again look to higher education for practical solutions. What might higher education's specific contributions be?

It seems to me that a short list would have to include -

- research that assists business and industry to advance the technological frontier,
- education and training of scientific and technical manpower needed by business and industry,
- preparation of all citizens to live in a technological society in which decisions are increasingly based on scientific and technological considerations, and
- research on how best to use technology to advance education at all levels.

It is a great challenge and opportunity for all of you involved in education. We must be bold in realizing our future tasks.

It was only a very short time ago in the panorama of human history that we had the invention of that very useful device we know as the telephone.

Even at the time of the invention of the telephone by Alexander Graham Bell, many of the more intelligent people of the time viewed it with skepticism. A common reaction might have been: Why would anyone want to talk to another person over a wire?

Let us focus for a moment on the invention of the telephone. In less than a century since the invention of the telephone, telephonic communication ranks as one of the all time critical change agents in the world.

This telephonic communication system made possible direct communication by one person with virtually any other person in the world and its impact has influenced the social, political and economic development of society. The creative genius of experts led to the expansion of

telecommunications to include such developments as satellite communication, data transmission, video transmission and slow-scan and cable television.

All of these developments brought significant changes as well as enormous opportunities for education. It changed the old master-tutor relationship; it brought education beyond the four walls of the classroom; it expanded opportunities to tap knowledge throughout the world and to bring the wisdom of scholars from the far corners of the globe to the immediacy of one's own classroom and home. These changes helped to transform the home as well as the classroom into a learning environment. The people who master this development will find that it will not only change their lives and the way they think of themselves as human beings but will profoundly affect the balance of power in the world.

It is important that we develop our human resources to the best extent possible for our survival as a nation. We have seen documented the decline of U.S. school standards since the early 1960s: class grades have remained up but real performance has gone down. Dr. Barbara Lerner has noted that this has occurred in a period where we have sent more of our young people to school for longer periods of time than any other nation in the world. American productivity has also declined during this period. Dr. Lerner warns that the U.S. might face the period where high level managerial, professional and scientific talent will be in short supply and consequently the U.S. may discover this situation bringing serious economic, political and social problems.

Perhaps the significance of the challenge we face in learning was best stated by Columbia University professor Diane Ravitch in her recent work The Troubled Crusade: American Education 1945-1980. Dr. Ravitch notes:

> To believe in education is to believe in the future, to believe in what may be accomplished through the disciplined use of intelligence, allied with cooperation and good will. If it seems naively American to put so much stock in schools, colleges, universities, and the endless prospect of self-improvement and social improvement, it is an admirable, and perhaps even a noble flaw.

And finally, in opportunity, the U.S. must once again regain confidence in its ability to grow and expand and develop. During the 1960s and 1970s we experienced in our public life advocates of limited growth and limited development, a philosophy leading to lack of confidence in ourselves and our society and a malaise prevalent in our institutions of higher education. The late Herman Kahn, in his last book, The Coming Boom, observed that one of the reasons he expected high and sustained growth rates through the 1980s and 1990s was because of a whole host of new technologies and technological improvements ripe for large-scale exploitation, notably computer networks.

The electronic learning, growing more and more popular, builds upon these amazing developments in society, in learning and in opportunity. The technology is here; the will to use it effectively must also be present.

I should mention that we need to be aware of the disadvantages or limits on this breakthrough--educators unwilling to change may resist; special interests may lobby vigorously against it fearing it will

replace teachers; competitors may undermine it for their personal interest; an apathetic public may fail to respond; quality of courses may be compromised in seeking a greater quantity of students; equalitarians may be dissatisfied with opportunities for access.

However, we need to recognize the great advantages--electronic learning can give greater access, more extensive educational opportunities, and an enhanced relationship between teachers and students; this development requires no knowledge of technology except the ability to push buttons; expansion of education is related to the declining cost of technology; a great educational system can further expand developing a more knowledgeable population and informed worker and consumer. An expanded and better educated population can assist American productivity at home, and American leadership in the world.

All of you gathered here--the innovators and inventors, the educators and education writers--all can play a vital role in this next stage of development for technology and education. As John Naisbitt writes in his final statement in Megatrends: "My God, what a fantastic time to be alive!"